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EDITORIAL.

Tea

Attention is directed to a review included in this number of a report by the Imperial Economic Committee on the subject of the preparation for market and marketing of tea.

The tea industry, in common with most other agricultural products, has suffered from the present general trade depression. The situation has been aggravated by an increase of production and, from the point of view of the Empire producer, from the competition of the Netherlands East Indies.

Interest in tea cultivation has widened in Malaya during the past few years, due in part to the development of Cameron Highlands, but also, be it noted, to the increased area planted on the plains.

In view of the economic crisis which still faces the tea industry, one may well consider whether the Malayan pioneers of tea production are justified in their optimism, or whether the result of their enterprise is likely still further to increase the world's stocks of surplus tea.

For an answer to this question one may turn once more to the report under review. We are there told that good quality tea has always commanded a remunerative price and we should here urge therefore the paramount necessity for local tea growers to concentrate their attention on quality rather than on quantity, if their object is of dispose of their crop on the London Market.

The report further emphasises the importance of careful manufacture in the production of high quality tea. Whether the tea be upland or lowland, the quality of the product can be influenced during the process of manufacture. In this matter, Malaya should be able to hold its own. Producers have ample opportunity of studying and taking advantage of the experience of our near neighbours—India and Ceylon. It is stated that tea production in those countries has made notable progress in the past ten or twenty years. It is perhaps advisable that former tea planters now in Malaya and who are once more interested in this commodity should pay due regard to developments in this direction which have been adopted in India and Ceylon since their tea-planting days. The influence of these practical men, backed by a knowledge of modern tea factory methods, should prove of great value at the present juncture of tea production in Malaya.

The Department of Agriculture, S.S. and F.M.S. last year sent an officer to Ceylon and India to report on the present methods of tea cultivation and manufacture. His report will shortly be sent to press and will be available to the public in 1932.

One further aspect of this question remains for consideration. The report stresses the wide field for the development of tea consumption in the countries of production. We have to ask ourselves whether there is room for further consumption of tea in Malaya, and whether local production will be in a position to satisfy or stimulate such a demand.

The net imports of tea into Malaya in 1930 exceeded 8,700,000 lbs. Our *per capita* tea consumption is therefore 1.99 lbs. per annum. This, in comparison with most countries outside the United Kingdom, the Irish Free State and the Dominions, is high. It must be remembered, however, that nearly 40 per cent. of the population of this country are Chinese who are consistent tea drinkers. Other local nationalities also favour this beverage. The object of the Malayan tea producer should therefore be first to market a class of tea which finds local favour rather than some other grades said to be suited to some problematical and distant market.

The market for locally produced tea is at our doors and is capable of extension and we feel that local producers are assured of a market in this country if they concentrate their attention from the start on the quality of tea for which there is a demand in Malaya.

Fruiting Ability of Oil Palms.

Little doubt is now entertained regarding the adaptability of the oil palm to plantation conditions. The crops of oil and kernel now being obtained on oil palm plantations, both in this country and in Sumatra, have fully justified the opinion held by the pioneers of the industry, that the yields, quality of oil and working costs of palms produced under estate practice would compare favourably with the product obtained from the areas of indigenous palms in Africa.

The estimate of the average yield from mature palms in Malaya was stated in Bulletin No. 39 " The Oil Palm in Malaya ", published four years ago, to be 16 cwt. of palm oil and 4 cwt. of kernels per acre per annum. Experience since that date shews that as a working basis, these figures still hold good. Some local oil palm estates are at present unable to reach the average while others have obtained yields much in excess of these figures. In one case, for instance, an annual yield of one ton of oil is recorded.

Such variations as occur may be due to variety of palm cultivated, local conditions of soil and drainage, or to systems of cultivation, manuring, artificial pollination and harvesting adopted. It is, of course, probable that all these factors are concerned, and it is only by the continued study of yields in relation to such factors that the ideal conditions may be attained.

In this number, Dr. Jack contributes an article on the "Variation in Fruiting Ability of Oil Palms", which supplies evidence concerning the variation in yield of individual palms. He shews that the variation is very considerable, being 47 per cent., which means that a very large proportion of the crop is obtained from a relatively small percentage of the palms. From individual tree records of crops he demonstrates that 25 per cent. of the total population of trees produced only 11 per cent. of the crop. It is therefore highly desirable in planting up an area, as far as possible to guard against the inclusion of the progeny of poor-yielding palms. Further, a study of individual tree records on poor-yielding blocks may, in some instances, lead to a consideration of the advisability of replanting certain sections with selected seedlings in order to increase the general average of the particular field.

Storage of Coconuts.

In an article on this subject, Mr. F. C. Cooke, Assistant Chemist for Copra Research, describes the system obtaining in Ceylon of storing coconuts for some time before using them for copra production. From his trials in Malaya of this system he draws conclusions of definite value to Malayan copra producers.

It must be remembered that Ceylon is in the enviable position of being recognised as the exporter of the finest quality of copra in the market and a close comparison of Malayan methods with those of Ceylon is therefore indicated if any serious attempt is to be made to improve the quality of our exports of this product.

The blind acceptance of the Ceylon system of copra production for application in Malaya is not to be contemplated, because there are considerable differences in climate and soil and in method of marketing.

The author states that while the Ceylon system of picking and storing green nuts is not recommended for Malaya, it might be employed with advantage in the case of the produce from such small holdings as find it necessary to pick nuts in a green condition as a precaution against theft.

Rubber Statistics for the N. E. I. 1930.

A review of *The Export Crops of the Netherlands East Indies in 1930* was published in the last number of this Journal.

The publication reviewed is in the Dutch language, but the tables are generally intelligible to English readers as the headings are all printed both in the Dutch and English languages.

Through the courtesy of the American Trade Commissioner, Singapore, we have received a copy of an English translation of the somewhat lengthy portion of the Report which deals with rubber.

This valuable translation is too long for inclusion in this Journal and further abstract or review would be of little value to the student of the rubber position. Copies of the translation may, however, be seen in the respective offices of The American Trade Commissioner, Singapore, the Director of Agriculture

at Kuala Lumpur, the Director, Rubber Research Institute of Malaya, Kuala Lumpur and of the Registrar-General of Statistics at Singapore.

Oil Palm Machinery

The Department of Agriculture, S.S. & F.M.S. has now published in the pages of this Journal accounts of several types of machinery employed for the production of palm oil and palm kernels on a large scale.

The principal types described are as follows :—

The centrifugal extraction plant made by Messrs. Manlove, Alliott and Co. Ltd., for whom Messrs. William Jacks and Co. (Malaya) are the local representatives, and the press installation, comprising stirring kettle, hydraulic press and pump by Messrs. Gebr. Stork and Co., for whom Messrs. Guthrie and Co. Ltd. are the local representatives. The experimental plants of the above makes, installed at the Government Experimental Plantation, Serdang, are described in Vol. XIX, No. 8. A more detailed description of the latter machinery is contained in Vol. XVIII, No. 10, under the title of "The Palm Oil Factory at Elaeis Estate, Johore".

The Krupp machinery for the extraction of palm oil, for which Messrs. Boustead and Co. Ltd. are the local agents, is described in Vol. XIX, No. 11, under the title of "The Production of Palm Oil on a Large Scale".

These accounts have been published for the information of those interested in oil palm manufacture. No one type of machinery has been recommended in preference to another, the object being rather to present to readers detailed information of the different types from which they may arrive at a decision of the type most suitable for their individual needs.

THE STORAGE OF COCONUTS AFTER HARVESTING

BY

F. C. Cooke,

Assistant Chemist for Copra Investigations.

Introduction.

The storage of coconuts after harvesting appears to be a practice which is followed exclusively in Southern India and Ceylon. Sampson, in referring to coconut storage, states that coconuts [1] which have been stored give the best quality of copra. At the same time, he qualifies this statement by declaring that the best plan [2] is to pick coconuts before they are ripe or dead-ripe and, should there be any doubt as to the condition of ripeness, that it is much better to pick the nuts before rather than after they are dead-ripe.

Rajapakse [3] describes experiments performed in Ceylon in which 120 coconuts were stored in a room and a similar number in the open. Ten coconuts were taken for conversion into copra monthly and the results shew that over 12 months, the yield from the coconuts stored in the room was constant, but that the yield of copra from those stored in the open declined after 4 months. In view of the small number of fruit examined on each occasion, the results cannot be regarded as conclusive.

Coconut Storage in Ceylon.

The writer paid a visit to Ceylon in July, 1931, to determine among other things the origin of the practice of coconut storage and to ascertain whether its adoption could be recommended to Malayan producers of copra, since the results of experimental work in Malaya were apparently unfavourable to the adoption of this procedure.

Coconut Harvesting.—It was found that, owing to local conditions, coconuts on the west coast of Ceylon generally fell in a greenish condition. Furthermore, for every green bunch that fell naturally, another bunch of still greener nuts was usually cut down. Even though the coconuts which have fallen will change in colour while waiting to be picked up, 90 per cent. of the nuts in the mixed crop, as received at the storage depôt, were not fully brown.

The copra obtainable from such a crop, under Malayan conditions of production, would be rubbery, wrinkled or testaless. The pieces would usually be distorted and fractured and would have a pale yellowish coloration. Furthermore, in Malaya, [4] green unripe nuts only give an average yield of .43 lbs. of

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Sampson, The Coconut Palm. (1) p. 220, (2) p. 70; (3) Rajapakse, Tropical Agriculturist, April 1918 p. 214..

4 Cooke, *Malayan Agricultural Journal,* October, 1931, p. 477.

copra, while the normal yield for dead-ripe brown nuts is .50 lbs. of copra per nut.

In Ceylon the fruit is invariably collected and transported whole and unbroken. In this way, the copra is kept free from bits of husk and dirt and from exposure to bacterial attack which might set in during the period of transport, and which would then produce the red-brown colour seen on carelessly-prepared copra.

The Storage Depôt.—Usually the bunches are brought into a central depôt in carts, and the loads are dropped on to the ground without any attempt at sorting, stacking or separation of the coconuts from the bunch. Sometimes, where armed watchmen are kept and the estate is surrounded by barbed wire, there are several depôts, or the main depôt is moved from place to place.

It is claimed that palms in the neighbourhood of a storage depôt are improved, provided the depôt is not kept too long in one place, since the underlying grass is killed and converted to humus and a certain amount of mineral matter is washed by rain from the decomposing husk.

The establishment of a permanent store in one place, particularly on heavy soils, is not good, since air is permanently excluded from the roots of the palm, damp or muddy conditions are induced in the soil and sour fermentation takes place. On one well kept estate, the only trees with yellow foliage were in the neighbourhood of the permanent central storage depôt.

Method of Storage.—The fruit is almost always stored unhusked, though a few middleman producers who purchase coconuts in small lots from small owners, store them in sheds in the husked condition.

In certain instances, where the crop includes a fair percentage of fallen brown fruit it is considered to be worth while, in order to avoid possibility of serious germination of the browner coconuts during the period of storage, to sort and to store only those that are green. The practice of selective storage if applied where necessary in Malaya, would doubtless assist materially towards improved quality, since the production of low grade copra from unstored green coconuts would thereby be avoided.

A heap of stored nuts covers a very extensive area, its height being generally about 3 feet and it is usually covered with palm leaves. If the coconuts are stacked higher instead of merely being dropped from the carts, the work becomes slower. On one 600 acre estate, for example, instead of 15,000 coconuts being brought in daily, only 10,000 would be handled. Furthermore, if the coconuts are heaped to a height of 6 feet, the underlying soil is compressed, the heap sweats on account of lack of ventilation and the fruits are more liable to germinate.

The number of coconuts so stored naturally depends primarily on the size of the estate and on the storage period. The latter is normally one month, but it may be slightly reduced for financial reasons or during a period of favourable copra prices. On the other hand, the period of storage may be considerably extended if the weather is too wet to make good copra or in expectation of an

improved price. A 1,000 acre estate would keep an average stock of about 500,000 coconuts.

When prices are steady, the fruits can be taken from the depôt to the kilns at a steady daily rate irrespective of crop fluctuations. This makes it possible to employ the same labourers continuously on drying so that speed and efficiency are uniformly maintained, the kilns are never out of use and never cool, fewer or smaller kilns are employed, and consignments of copra can be despatched regularly.

Changes during storage.—The meat of a stored green nut is less sweet, harder and more fibrous than that of the unstored green nut, indicating that changes occur during storage. When green nuts are stored in Ceylon, the haustorium visible after storage rarely exceeds pea size, and advanced germination is found only after about six months. If the nuts are picked too immature, they spoil with storage and conversely, ripe nuts germinate in storage. It is essential, therefore, that collection shall be regular and thorough.

While it was suggested by one or two producers in Ceylon that the oil and copra content of green coconuts will improve on storage, experimental work does not confirm this impression.

THE ADVANTAGES RESULTING FROM COCONUT STORAGE IN CEYLON.

The advantage resulting from the storage of the green coconuts harvested in Ceylon, may be summarised as follows :—

(1) Husking is made easier, green unstored coconuts being very difficult to husk.

(2) Shelling is cleaner and easier, since the brown skin of the coconut meat does not adhere to the inside of the shell, as it otherwise would do.

(3) The resulting shells are dry, hard and husk free, and when used as fuel, they burn continuously and with the production of little smoke.

(4) Copra can be dried at a constant rate, irrespective of crop fluctuations, thus :—

  (*a*) fewer or smaller kilns are used;

  (*b*) the same labourers are in constant employment;

  (*c*) standard drying procedure is assured.

(5) If necessary, the production of copra during prolonged spells of wet weather may be suspended.

(6) Additional copra may be prepared when high prices are ruling, and if this practice is general, it provides a local price stabiliser.

(7) As the green coconut matures and turns brown, the contained meat and its brown skin (testa) hardens thus :—

  (*a*) The production of leathery, wrinkled, testaless and mis-shapen or coloured copra is reduced from about 15 per cent. to about 1 per cent.

(*b*) Smooth, white, round (i.e. not triangular) opaque copra is obtainable (if slow drying is practised).

(*c*) Since hard wet meat appears to offer greater resistence to bacterical sliming than the softer wet meat of unstored green nuts, only where there is extreme carelessness is coloured copra to be seen.

(*d*) A uniform raw material may be expected to and does produce a uniform quality of copra.

(8) The extensive heaps of stored nuts kill the underlying grass.

Coconut Storage Experiments in Malaya.

In view of the good quality of Ceylon copra and the high price which that copra commands in the European market, the subject of coconut storage has been given considerable attention in order to determine.—

(1) Whether the practice would give improved yields of copra in Malaya;

(2) Whether, if the practice were generally adopted, the percentage oil content and the quality of Malayan copra would also improve.

Method.—A series of seven groups of large scale experiments was conducted on six different estates adopting a storage period of one month. In the course of the work, a total of 4,400 coconuts was used.

Since the fruits were collected promiscuously and since the methods of copra preparation on each estate do not provide standard conditions the results recorded in Table IV on close examination reveal a few minor irregularities that are absent in Table V, which is the record of the picked crop sorted and stored from a selected area on a single estate.

Experimental Conclusions.—The results of coconut storage for one month are as follows :—

(1) Colour changes in the fruit and nut.

Table I.
Physical Changes Compared.

Before Storage.		Method of storage.	After Storage.	
Fruit.	Nut.		Fruit.	Nut.
Wholly green coconuts.	White to brownish yellow with adherent husk.	In shade.	Shrivelled, cracked, and brown.	Clean brown.
		In sun.	Very light brown.	Clean brown.
Wholly brown. coconuts.	Clean brown.	In sun.	Bleached, light grey, sprouting.	Wet brown.
		In shade.	Brown and sprouting.	Clean dark brown.

It will be seen that coconuts appear to mature in storage.

(2) Germination in Storage.

Table II.

Ripe and Unripe Coconut Storage.
Comparison of Spoilage.

Before Storage.	Method of storage.	After Storage.				Spoilage per cent.
		Number rotten.	Number un-germinated.	Number germinated.*		
				pea to 2″	2″ upwards	
50 wholly green coconuts.	In sun	3	5	42	0	6
	In shade.	3	14	33	0	6
50 wholly brown. coconuts.	In sun	6	2	18	24	60
	In shade.	5	3	14	28	66

* The dimensions given refer to the diameter of the enclosed haustorium or "apple".

It will be seen that green coconuts do not germinate to any great extent during one month of storage.

(3) Rotting in Storage.

In one area inspected, meat development within the nut was poor and nut rotting was rather common. Here green coconuts rotted to the same extent in storage as when left to ripen on the palm.

Table III.

Green Coconut Storage.

Table showing that spoilage is not emphasised when green coconuts are stored.

Groups of 300 coconuts.	Number spoiled.		Rejections per cent.
	Rotten	Corroded and discoloured.	
1. Green unstored ...	2	9	3.7
2. Brown unstored ...	5	18	7.7
3. Green stored ...	2	21	7.7

(4) The effect of storage on yield.—

There appears to be no increase in contained oil and copra if coconuts in any condition of ripeness are stored for one month. On the contrary, the yields of both are actually slightly reduced. Therefore, since unstored green coconuts ordinarily yield in Malaya much less oil and copra than unstored brown

coconuts and since the effect of storage will be to reduce the yield still further, the picking of green coconuts and subsequent storage is not recommended to copra producers in this country.

Table IV.

Nut Storage Experiments on 5 Estates.
Comparative Yields of Oil and Copra per 100 nuts for Unripe and Ripe Nuts, and Unstored and Stored Nuts.

Estate	Groups of 100 nuts	"Dry" Copra obtained (lbs.)		Oil percentage (Dry Basis)		Total Oil (lbs.)	
		Green unripe	Ripe brown	Green unripe	Ripe brown	Green unripe	Ripe brown
A	Unstored	37	48	69.1	65.2	26	31
	Stored	34	44	66.5	67.8	23	30
B	Unstored	48	60	67.8	64.7	33	39
	Stored	48	54	66.2	67.9	32	37
C	Unstored	47	56	67.5	65.2	32	37
	Stored	47	53	66.7	65.2	31	35
D	Unstored	41	44	66.8	63.9	27	28
	Stored	40	41	66.7	64.9	27	27
E	Unstored	42	43	61.9	62.3	26	27
	Stored	39	43	63.9	66.9	25	29
Average	Unstored	43	50	66.6	64.3	29	32
	Stored	42	47	66.0	66.5	28	31

On each estate, the nuts were collected promiscuously.

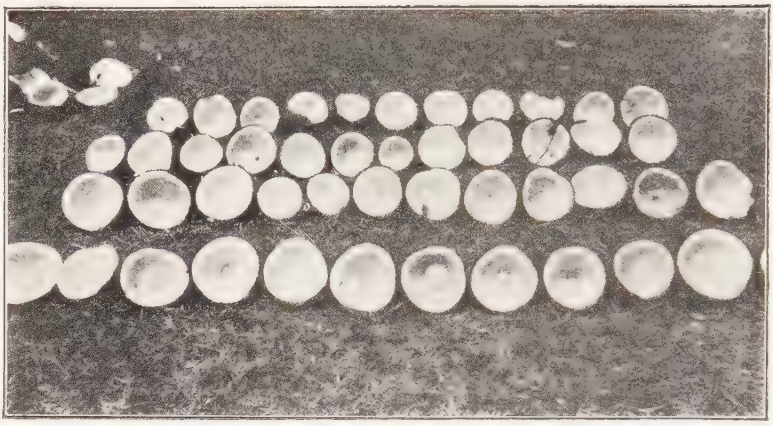
(5) Changes in the percentage oil content.—

There would appear to be some tendency towards an increase in the percentage oil content of the resulting copra, when coconuts are stored.

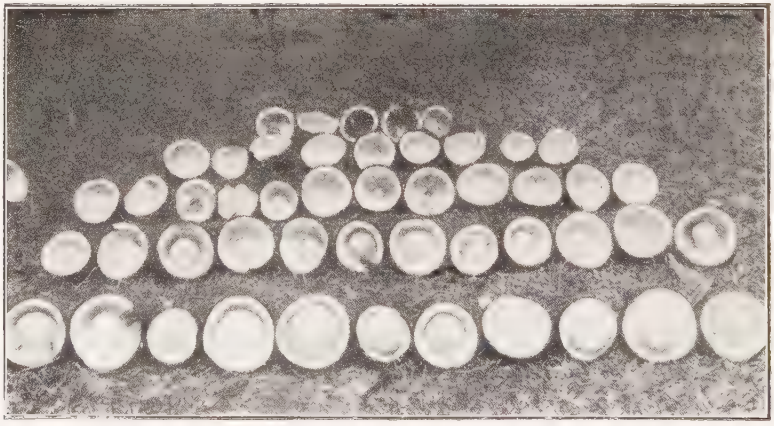
When the storage of brown coconuts is practised, the loss of copra is most marked, though the remaining copra becomes progressively richer in oil as erosion through germination proceeds, owing to the existence of the oil gradient in the

Green Coconut Storage in Ceylon
An Outlying Depot.

Green Coconut Storage in Ceylon
A Central Depot of 500,000 Nuts.



Unripe Green Coconuts After One Month's Storage.
Note: No advanced germination.



Ripe Brown Coconuts After One Month's Storage.
Note: Discoloured and Rotten Nuts.

white endosperm.[5] On no account, however, is brown coconut storage to be recommended.

Table V.

Comparative nut storage experiments conducted on one estate.
(800 picked nuts examined)
The effect of storing nuts of different degrees of ripeness.
Estate F.

200 nuts stored for one month and then kiln-dried.	"Dry" copra per nut (lbs.)		Oil per cent. (Dry basis)		Total oil per nut (lbs.)	
	Before storage.	After storage.	Before storage.	After storage.	Before storage.	After storage.
Wholly green but fully developed nuts.	Average. 0.53 lbs.	Average. 0.52 lbs.	65.7	67.7	Average. 0.53 lbs.	Average. 0.53 lbs.
Partially green nuts, turning red brown.	0.59 „	0.59 „	64.9	66.6	0.38 „	0.39 „
Red brown nuts nearly ripe.	0.60 „	0.56 „	64.3	67.8	0.39 „	0.38 „
Fully brown unsprouted nuts.	0.60 „	0.54 „	64.7	67.6	0.39 „	0.37 „
Mixed Crop (average).	0.58 lbs.	0.55 lbs.	64.9	67.4	0.38 lbs.	0.36 lbs.

(6) The effect on quality.—

Unless they are severely under-ripe, the storage of green coconuts results in the production of copra equal in quality to that produced from unstored ripe brown coconuts, under similar conditions of careful preparation.

If green coconuts are not stored, the copra then obtainable will be of poor quality, since as stated previously, a large percentage of wrinkled, discoloured, testaless and rubbery pieces will be found.

In small holdings, if owing to the fear of theft, two out of every three nuts are collected in a green unripe condition, in order to avoid the production of unsightly copra, it is strongly recommended that selective storage should be applied. Thus, while the wet meat from the ripe brown coconuts may be converted to copra at once, the green coconuts should be set aside and stored for one month, so that they may mature.

It must be clearly understood that this recommendation is one of expediency and that on estates, it is better to harvest as few green coconuts as possible in order that optimum yields of copra may be obtained.

The Cost of Coconut Storage in Ceylon.

While, owing to the high standard of excellence of Ceylon copra, due to the

5. Cooke, *Malayan Agricultural Journal*, March, 1931, p. 131.

careful method of preparation practised by the large majority of producers, the product is able to command a premium of about 75 cents a picul over Straits No. 1 copra, this advantage is partially offset by the necessity for coconut storage in order that high quality may be made possible, under the conditions prevailing.

A well-managed Ceylon estate is selected to provide an example :—

Area	1,000 acres.
Annual crop	4,000,000 nuts (approx.) or 13,000 piculs of copra.
Average number nuts in storage	500,000 nuts.
Storage period	1½ months.
Cost of bullock transport	17 cents (Straits) a load.
Bullock cart loads	(a) 2,000 husked nuts.
	(b) 500 whole coconuts.

Transport from the field to the central depôt for

2,000 whole coconuts	costs 67 cents.
2,000 husked nuts	,, 17 ,,
	—
Extra cost of transport :	50 cents. (Straits) per 2,000 coconuts.

Therefore the cost of green coconut storage on this estate is made up as follows :—

		$ per annum
(1)	Additional transport charges on 4,000,000 nuts as above	1,000
(2)	Probable loss of copra due to collecting 90 per cent. unripe nuts (at 1,250 piculs of copra lost) =	6,250
	Total cost of coconut storage per annum	$7,250

This represents an additional charge of 56 cents a picul.

Other financial considerations.—The cost of husking Ceylon coconuts is reduced very considerably after they have been matured by storage since green coconuts, as normally harvested there, are extremely difficult to husk, thus :—

	Husking Speed.
Green unstored nuts ...	500 nuts per man per day
Stored nuts ...	2,000 nuts per man per day

In addition, allowance must be made for the fact that regular and efficient working at the kilns is probable, since the same attendants are in continuous employment and finally, since additional copra can be made when prices are high, coconut storage operates as a local price stabiliser.

Conclusions.

It would appear :—

(1) That the copra obtainable from green coconuts after storage would be equal in appearance to that obtainable from correctly harvested brown coconuts;

(2) That the copra obtainable from unstored green coconuts would contain a high percentage of unsightly copra (wrinkled, discoloured, testaless and rubbery) under similar conditions of preparation;

(3) That where the fruits fall in a ripe brown condition and where care is taken only to harvest coconuts that are fully brown and ripe, the highest possible yields of oil and copra would be obtained, whereas reduced yields of oil and copra would result if green coconuts were harvested, either for subsequent storage or for immediate preparation of copra;

(4) That coconut storage is, however, necessary where the fruits fall naturally in the green unripe condition, or need to be so collected, otherwise irregular drying and poor quality results;

(5) That coconut storage is therefore necessary in Ceylon and that it is partly responsible for the uniform and good quality of Ceylon copra since a uniformly matured and clean raw material is thereby handled at the kiln;

(6) That where it can be avoided, as on those Malayan estates where careful fruit harvesting is practised and where the percentage of unripe coconuts present in the mixed crop is negligible, coconut storage is not to be recommended;

(7) That it is inadvisable for Malayan estates to adopt green coconut harvesting with subsequent storage for one month, in imitation of Ceylon practice owing to reduced yields that would result;

(8) That where a large percentage of unripe fruits is normally included with the crop (e.g. in native small-holdings) those coconuts that are markedly unripe should therefore be picked out and set aside to mature for one month. In this way the possibility of an irregularly dried and unsightly product is lessened, and copra of uniform dryness and quality may, if other conditions are satisfactory, be readily obtained.

VARIATION IN FRUITING ABILITY OF OIL PALMS

BY

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The oil palm in common with fruit trees generally, exhibits a wide variation in the amount of fruit produced by individual palms. In Malaya, attention was first given to the study of variation in cropping of this palm at the Goverment Experimental Plantation, Serdang, where in 1924, records of the fruiting ability of individual palms were made on an avenue of 86 palms which were planted in May 1922. The 43 palms on each side of the avenue were spaced 30 feet apart while the south side of the avenue was 36 feet distant from the north side.

The palms forming the south side of the avenue were artificially pollinated (one bunch per month) from August 1924, while the palms on the north side were left for pollination by natural means. A comparison of the resulting fruit yields in 1925 published in 1926 by Milsum and Curtler[1] showed that five times as much fruit was produced by the palms which had been artificially pollinated as was produced by the control palms and that the individual yields per palm varied from practically nothing up to 161 lbs. of fruit.

The same palms were under observation in 1926 and the records taken in that year and in 1927 by Marsh[2] and[3] confirmed the results found in 1925 and showed that marked variation in individual yields per palm occurred with these comparatively young palms growing under avenue conditions. It seemed desirable that the range of variation under ordinary plantation conditions should be investigated to provide data for selection of high yielding palms on a much wider scale than that afforded by the avenue grown palms at Serdang. In consequence, the following notes have been derived from a study of a block of 589 palms growing in a square block on a local estate (Elmina) under good average conditions. The chief aim of this study was the discovery of heavy yielding palms for further observation and breeding experiments with a view to the production of high yielding strains for general cultivation.

The palms in the block under observation were planted in 1920-21. The planting distance was 30 x 30 feet square; the land is flat except at one corner where it includes rising ground, and this corner carried seventy-five palms. The soil consists of a well-drained, medium to light porous loam except that the undulating portion is of typical laterite loam. The collection of data commenced in January 1929, and records were taken once each week, but as artificial pollination was carried on during the first six months of the experiments and as it was obvious that many of the palms were not yet mature, the figures in Table 1 relate only to data recorded during 1930 which was a good cropping year.

Artificial pollination of the palms ceased in July 1929, and by the end of that year over ninety per cent. of the total number of palms could be classed as mature.

The weights of bunches of fruit were taken and whenever over-ripe bunches were encountered, all fallen fruits were carefully collected and their weights added. The results are tabulated in the following frequency table, which shows a wide range of variation (0 to 680 lbs.) in fruit production from 589 palms during 1930 and reveals a coefficient of variability of 47 per cent. (approximately).

Thus, this crop, as judged by a study of ten year old palms, appears to be more variable than coconuts locally since the latter have a variability of 34 per cent.(5)based on records of mature palms—possibly the oil palms are still rather young.

TABLE I.
Frequency Table.

Variation in yield of fruit bunches per palm for 589 palms in 1930.

Groups	Frequency	Deviation	(Deviation)^2	F x D^2
0 lbs.	3	260	67,600	202,800
15 „	9	245	60,025	540,225
50 „	10	210	44,100	441,000
85 „	26	175	30,625	796,250
120 „	52	140	19,600	1,019,200
155 „	49	105	11,025	540,225
190 „	70	70	4,900	343,000
225 „	72	35	1,225	88,200
260 „	56	0	0	0
295 „	59	35	1,225	72,275
330 „	52	70	4,900	254,800
365 „	41	105	11,025	452,025
400 „	34	140	19,600	666,400
435 „	23	175	30,625	704,375
470 „	8	210	44,100	352,800
505 „	10	245	60,025	600,250
540 „	5	280	78,400	392,000
575 „	5	315	99,225	496,125
610 „	3	350	122,500	367,500
645 „	1	385	148,225	148,225
680 „	1	420	176,400	176,400
No. =	589	Mean =	260	Total = 8,654,075

Standard Deviation = 121 Coefficient of variability = 47 per cent.

With regard to the above table, of the three palms which failed to produce fruit, two produced only male flowers during the year, and the third was obviously suffering from disease and had been severely treated. The actual mean production per palm was 257 lbs., but 260 has been taken as the mean for grouping purposes in working out the variation.

Separate calculations of the variability of the 75 palms situated on the undulating land and of the 514 palms growing on the flat area revealed coefficients of variability of 40 per cent. and 46 per cent. respectively, but the average yield per palm on the sloping land was found to be only 202 lbs. as compared with 268 lbs. on the flat land, the difference being probably due to lack of sufficient moisture on the undulating land. Also, it is probable that 75 palms are not a sufficient number to give a true indication of variability on the undulating land.

An examination of the yield figures shown in Table 1 discloses the fact that approximately 25 per cent. of the total population (or 149 poor producing palms) produced only 11 per cent. (16,680 lbs.) of the total crop (151,415 lbs.). Similarly, of the palms which produced better crops than the average, 9.5 per cent. (56 palms) of the population produced 18 per cent. (27,545 lbs.) of the total crop, 15 per cent. of the palms produced 27 per cent. of the crop and 30 per cent. of the palms produced 48 per cent. of the total crop.

These figures are fairly comparable with those previously found by the senior writer for coconuts([4]) and([5]) and for rubber ([6])both growing under fair average estate conditions in this country, and indicate a wide scope for selection amongst the better yielding palms, since it appears from fruiting records on young palms extending over 5 years taken by the staff of the Agricultural Division of the Department of Agriculture at the Government Experimental Plantation, Serdang,([7])that good yielding palms constantly produce good crops. The average production of bunches of fruit is approximately 260 lbs. per palm per annum. The table shows that 100 palms or 17 per cent. of the total number produced less than half that average crop. These palms would therefore probably be classed as uneconomic unless they could be stimulated by cultural or manurial methods to give better returns. On the other hand, 90 palms or 15 per cent. of the total population produced over 50 per cent. more crop (or over 400 lbs. of bunches per palm) than the average, and though the immediate environment of each palm undoubtedly plays a large part in its productive ability, it may safely be assumed that some at least of these 90 high yielding palms owe their heavy yielding characteristics to hereditary qualities, and it is from them that selective and breeding methods may be expected to produce the most remunerative results.

In Table 2, the average annual crops of the ten best palms at Serdang and of twenty of the best palms at Elmina, for 2½ years are given. From these thirty selections, it is hoped to plant progeny in due course in order to investigate further the problems affecting yielding capacity and to provide a supply of good seed palms; indeed, the Serdang selections have already been planted for those purposes.

As regards the Serdang palms, all of which were artificially pollinated, the yields are made up to date from the "Guide to the Government Experimental Plantation, Serdang F.M.S. January 1931" and the pericarp percentages (column 4) which vary from 56 to 67 per cent. are derived from figures given by the writers in a perliminary note on variation of individual fruits. ([9])

The yields and pericarp percentages (varying from 55 to 76 per cent.) of the Elmina selections have been abstracted from unpublished records of the Economic Botanist, S.S. & F.M.S., in which the pericarp percentages are averaged from 75 fruits taken in three different pickings of twenty-five fruits each. The percentages can only be considered as approximations since they are calculated from differences between weights of fruits and weights of nuts and full precautions were not taken to avoid loss of moisture from the nuts before weighing them, although since little time was lost in the processes, the error is probably less than 3 per cent.

TABLE II.

	Palm No.	Weight of fruit in lbs. per palm per annum.		Pericarp on fruit. (per cent.)	Average wt. of pericarp per palm per annum in lbs.	Average per cent. of kernel on fruit.	Average weight of kernel per palm per annum.
		Bunches	Clean fruit.				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
SERDANG.	27	516	346	60	208	7.5	25.9
	37	420	284	58	161	6.9	19.6
	3	426	280	64	180	6.9	19.3
	7	424	276	62	171	8.0	22.1
	5	412	272	63	171	6.7	18.2
	9	414	260	60	156	8.0	20.8
	23	412	252	56	141	9.3	23.4
	57	356	236	64	151	6.7	15.8
	65	332	226	61	138	7.6	17.2
	67	334	198	67	133	6.1	12.1
	Averages	405	263	61	161	7.4	19.4
ELMINA.	214	648	389	64	249	4.9	19.1
	270	547	328	68	223	5.7	18.7
	207	526	316	64	202	6.1	19.3
	267	507	304	62	188	8.0	24.3
	242	503	302	61	184	8.6	26.0
	268	492	295	70	206	4.9	14.4
	360	483	290	62	180	5.5	15.9
	243	454	272	59	160	9.0	24.5
	180	450	270	59	159	5.2	14.6
	20	440	264	58	153	6.4	16.9
	208	437	262	55	144	10.6	27.8
	141	430	258	61	158	6.0	15.5
	179	429	257	62	159	6.5	16.7
	120	414	248	76	188	3.9	9.7
	27	411	247	63	156	6.0	14.8
	97	405	243	63	153	5.2	12.6
	36	402	241	62	149	4.9	11.8
	152	394	236	74	175	2.9	6.8
	88	386	232	62	144	5.4	12.5
	94	374	224	63	141	5.8	13.0
	Averages	457	274	63.4	173.5	6.7	16.7

The figures in columns 2 and 3 are the averages calculated from the yields obtained in the two and half year period ending July, 1931.

Palm oil is the chief commercial product of these palms, but for convenience, and since for general purposes it can be assumed that the oil content of the fruits is directly proportional to the amount of pericarp they contain provided that moisture contents are comparable, the average yielding ability of the selected palms has been expressed in pounds of pericarp in column 5.

The figures in this column show the calculated average annual yields of pericarp per palm, which for the Serdang selections (artificially pollinated) range from 133 lbs. to 208 lbs., while for the Elmina selections (natural pollination) the variation is even greater—141 lbs. to 249 lbs. per palm. In this connection, no doubt the lie of the land, its texture, and water-retaining capacities play an important rôle, but it must be borne in mind that the selections from Elmina have been made from a very much larger population of palms than those at Serdang and hence better selections should normally result.

Palm kernels form the secondary export product of this palm, so that the production of kernel per palm is shown in column 7 of the above table, and the percentages of kernel to clean fruit shown in column 6 are derived from figures given in (9) and from unpublished records to which reference has already been made. The figures in column 6, like those in column 4, cannot be regarded as accurate, but they are fairly comparable as they have been derived from triplicated tests on lots of 25 fruits collected at different dates in each case, and indicate the wide variation which occurs in this character (from 2.9 per cent. to 10.6 per cent.) amongst these thirty selected palms.

Most of the selections at Serdang and all the selected palms at Elmina are situated on the flat land and obviously some of them occur in good patches of soil—(Serdang 3, 5, 7and 9 with similar average yields are contiguous palms, as are 65 and 67 while at Elmina 267 and 268 and 179 and 180 occur together in pairs), still it may safely be assumed that in many cases, the variation in yield is due to inherent qualities. Unfortunately, the only method of defining the inherently high yielders from those which have given good records on account of particularly favourable soil conditions is by a study of their progeny yields and as propagation is only possible by seed, this is a slow but necessary process and will be initiated as early as possible from selfed and cross-pollinated seed. The facts of variation which have been cited show that the average annual yield of oil palms under good estate conditions is approximately 260 lbs. of fruit bunches per palm. This, according to Bunting, Eaton and Georgi,(8)is equivalent to about 155 lbs. of clean fruit, or roughly 90 lbs. of pericarp (45 lbs. of palm oil assuming 36 per cent. of moisture in the pericarp). With one exception (Serdang 67), all the selected palms show calculated yields of more than 50 per cent. in excess of the average, while 18 of the thirty selections show estimated yields 75 per cent. better than the average, and 10 palms even exceed the average by 100 per cent. or more.

Similar variation applies in the case of palm kernels, though these are of much less importance than the pericarp.

This wide range of variation of fruit production per palm (the percentage of pericarp on the fruit also shows some variation) should be of material interest to the planter as it indicates valuable commercial possibilities with this crop and provides ample scope for continued investigation of the yielding ability of selected palms.

Summary.

A comparison of crops from naturally and artificially pollinated young palms growing under avenue conditions is mentioned.

Variations in yield of naturally pollinated palms under ordinary estate conditions are defined and show a coefficient of variability of 47 per cent.

The yields of selected high yielding palms indicate ample scope for a continuation of field testing and of breeding investigations for commercial utility.

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METHODS OF TRAPPING CRABS IN PADI FIELDS IN KEDAH

BY

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Following up the success recorded* last year in the control of the fresh-water crab, *Paratelphusa sexpunctata,* by means of pot-traps, further experiments were made this season at two places, namely Jitra and Langgar. At both places the crabs would have caused a serious loss of crop had it not been for the control measures undertaken as soon as attacks were observed. The result of the action thus taken was an early reduction in the number of crabs at the critical time, that is, when the padi seedlings were still in a tender stage of growth after planting and it was possible for the crabs to tear away the leaf-sheaths and eat out the crown. Practically no damage was done and no re-planting was necessary as had been the case during the previous year.

At Langgar, pot-trapping alone was tried and most of the crabs were quickly captured. The pots were removed at the end of 26 days, that is, when no more crabs could be caught. Subsequent visits showed that there were no more attacks.

At Jitra, on the other hand, the number was such that it was found necessary to supplement pot-trapping with hand-collection and the use of fish-traps. The results were as follows:—

(1)	Pot-traps	781 crabs
(2)	Hand-collection	191 ,,
(3)	Fish-traps "Bubu"	206 ,,

Ten pots were used in this plot of about 4½ acres. The pots were sunk in the ground below water level and were baited with fried rice bran as described in the article (*loc : cit*).

Hand Collection.

About one week after transplanting it was considered unsafe to allow much water into the field from the irrigation canal as this would have led to an increase in the activity of the crabs which prefer a well-filled rice field. This method, however, cannot be recommended in areas which are dependent on rain-fall because an insufficient water supply might cause further damage to the crop. In the present instance it was possible to reduce the water supply as the area is irrigated and water could be admitted at will. In very shallow clear water, the crabs could be readily seen in the depressions in the field where the water was deeper. In a dry field, especially during the heat of the day, it was

* Sands, W. N. *Malayan Agricultural Journal,* Vol. XVIII, page 568.

still easier to catch the crabs when they were seeking cooler and better watered portions of the field. Hand collecting began on the day the plants were transplanted and continued for about a fortnight.

Trapping with "Bubu".

This fish-trap needs, perhaps, some description as it was the first time that it had been used for the purpose.

It is made with fine bamboo sticks laced with split rotan to a frame about 2¼ feet long. This frame is circular in shape at one end and is rather flattened at the other. The circular end has a diameter of one foot, while the flat end measures 1¼ feet in length and 5 inches in breath. At the circular end of the trap is fixed the trap-door having a wide mouth which fits into the frame. It is made of the same material and is conical in shape. It is made in such a way that the sloping end which points inwards and is not closed in the centre allows a crab to enter, but once inside it cannot get out. The entrance leads into a small compartment and from this into a large one with another trap-door entrance of lighter construction. At the end of the trap is a small door which can be opened and closed and from which the captives are taken out and destroyed. This door is generally made of wood and is hinged with rotan.

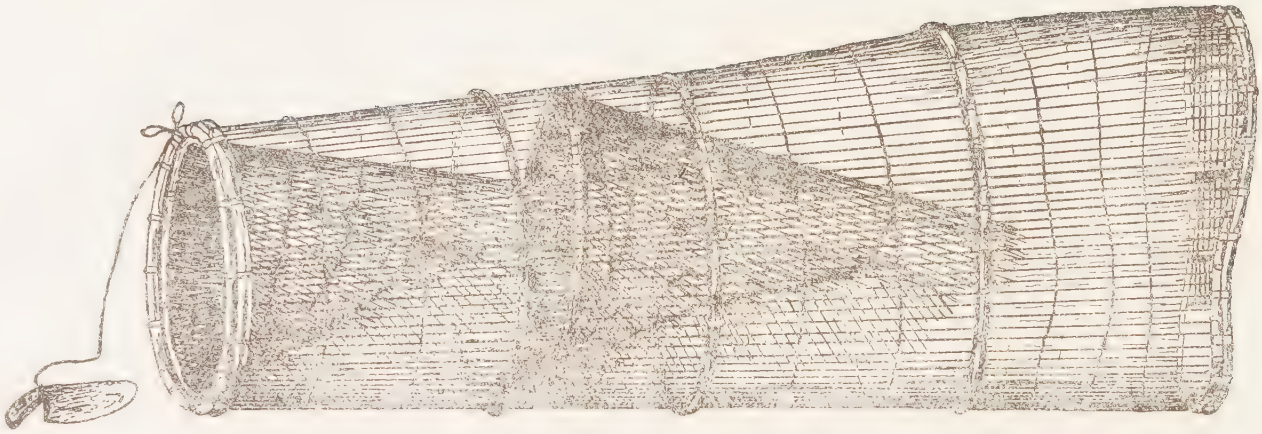
This "Bubu" was placed at a point where excess water from the rice field was run out, as it was observed that the crabs migrated from field to field in search of food with the flow of the water, whenever suitable opportunity occurred. Trapping with "Bubu" was stopped at the end of 17 days, when no more crabs were caught.

Young seedlings are considered to be out of danger when they are about 3 weeks old from the time of planting. After that the crabs seek other places in which to carry on their existence. Further, it was observed that the crabs always sought the low-lying portions of the field which were under deep water. It was also noticed that the crabs from an adjoining field, which had been dry owing to broken bunds, continually travelled to the plot where the experiments were carried out. A few were found moving in the day time and were caught by hand, but the greater number usually came in at night, judging from the results of the pot-trapping.

Trapping with Bamboo Joints.

Another very ingenious method has been devised by a local Malay, namely, trapping by means of large bamboo joints 1¼ feet long and with an inner diameter of 1¾ inches.

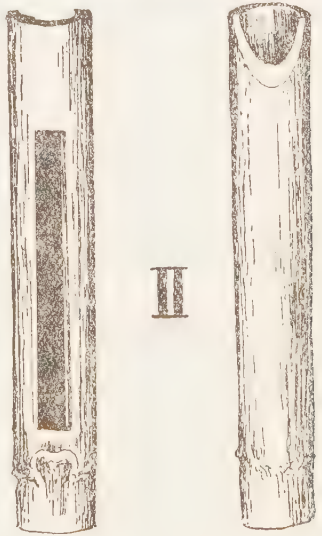
Description.—The bamboo joint is cut just below the node at each end so that one end is closed and the other open. About half the circumference of the open end is cut at an angle of 45 degrees to make it easier for the crabs to enter. A slit of 1/3 of an inch wide and 10 inches long is also opened along one side of the cylinder starting just above the node.



I

I Fish trap known as "Bubu"

II Two views of the bamboo crab-trap.



II

Bait.—The bait used is fried rice tied into a small bundle with a piece of cloth and placed at the far end of the cylinder.

Mode of Employment.—The traps are laid flat on the ground below water and are examined every day by covering the open end with one hand so as to prevent the crabs escaping and then lifted up to allow the water to run through the slit.

About 150 of these cylinders were used over an area of 15 acres. The average catch was about 2 crabs per cylinder per day. The man in charge put the total number caught at about 9,000 in one month, after which period he stopped trapping as his padi had grown out of danger. The statement was supported by several people in the neighbourhood.

The outstanding feature in the use of this kind of trap is its cheapness and its simplicity. Furthermore, it can be made in any quantity on the spot at a very short notice and is unlikely to be stolen. The traps employed by the man in question were made by himself. The captured crabs are not touched by hand but just emptied out of the bamboo-joints by shaking them into a kerosine tin The crabs caught are then killed with boiling water.

PISANG SA-RIBU

BY

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This curious banana, referred to in Java as *Musa chiliocarpa,* Backer, has been established at the Government Experimental Plantation, Serdang. The illustrations represent specimens cultivated at Serdang. A single sucker was obtained originally from a Malay holding at Batu Caves, Selangor. The banana was introduced under the name of Pisang Sa-ribu (Malay: Pisang, banana; Sa-ribu, one thousand) but subsequently a second name Belalai Gajah (Malay: Belalai Gajah, Elephant's trunk) was stated to be used in Selangor.

Pisang Sa-ribu differs from all other cultivated bananas in that the proportion of male and female flowers is the reverse of normal. In place of the small number of fruit-producing and large number of male flowers ordinarily occurring, the flowers almost all produce fruit. Consequently, with the exception of a small number of neuter flowers at the commencement of the inflorescence, the fruit stalk carried an extraordinary number of fruits forming a compact tapering bunch. The fruit-producing flowers have perfect stamens bearing pollen.

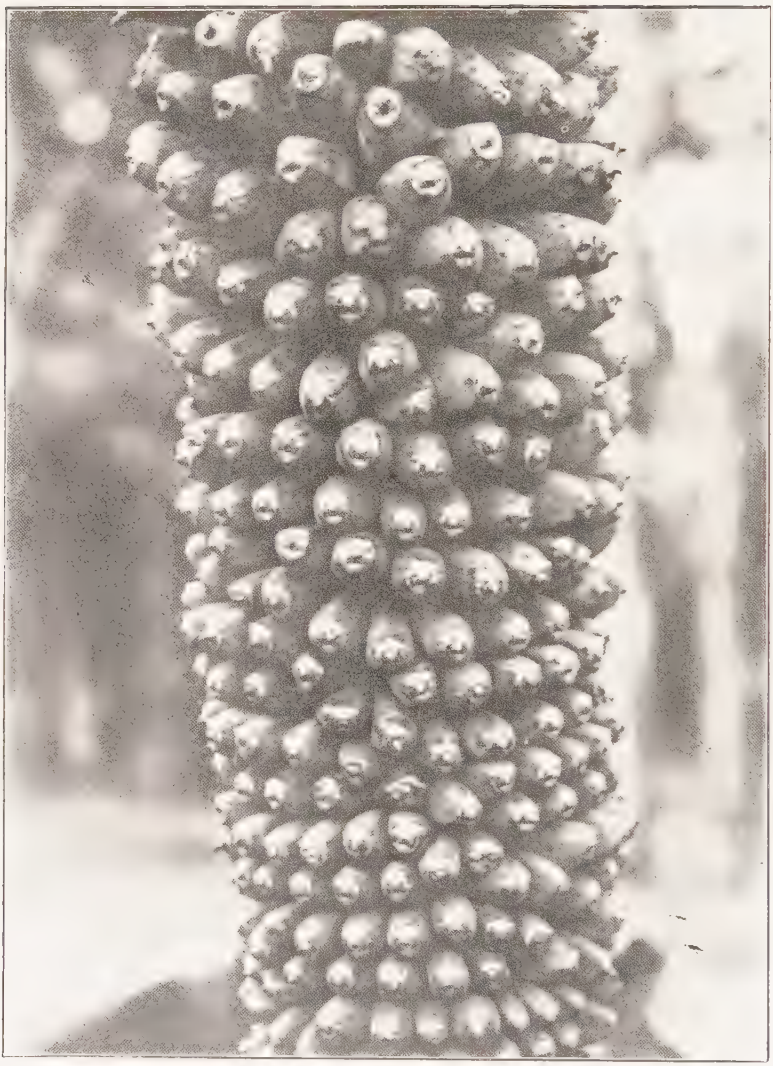
The original sucker produced an inflorescence during May, 1930 and the fruit bunch ripened in the following November. The bunch was about 5 feet long, with 125 hands, each hand bearing about 14 fruits. A total of over 2,000 fruits matured.

Several suckers were obtained from the old stool and planted about the middle of November, 1930. Flowering stalks appeared during April, 1931, the fruit bunches ripening six months later.

The following is a description of an average bunch when ripe. Length 6 feet, neuter hands 6, with 10 to 14 imperfect fruits on each hand. Perfect fruits numbering altogether 2,850 contained in 170 hands. A number of unopened female flowers remained on the "heart" when the bunch was cut. This is a smaller bunch than that recorded from Java, where a raceme 6 feet 5 inches long consisting of 151 hands, numbering altogether 3,137 fruits was described (*Teysmannia,* Vol. XIV, 1903, page 35). The mature fruit is 2 inches long and 1 inch in diameter. Skin yellow with chocolate spots and of thick texture. Flesh floury, creamy yellow, golden yellow in centre, good flavour but too small to be eaten.

Although Pisang Sa-ribu is of little or no value as a fruit it would appear to have possibilities in the hands of the plant breeder owing to its comparatively unlimited fruiting capacity. The fruits so far examined were quite seedless, but the pollen appears virile. Several Malayan bananas under cultivation at Serdang produce edible fruits containing seeds, namely; awak betul, awak legor, abu batu, and susu. Pisang awak legor is the most consistent seed producer. The individual fruits of this variety contain an average of 30 seeds, the majority of which germinate readily.

Pisang Sa-Ribu.
Fruiting bunch 6 feet long.



Pisang Sa-Ribu.
Mature fruits, reduced.

Abstracts

THE PRESENT STATUS OF STAPLE-CROP PRODUCTION IN THE PHILIPPINES*

This article indicates that the Philippines import annually foodstuffs to the value of some $27,500,000.†

The chief items of import are rice, tobacco, vegetables, fruits and nuts, coffee, cocoa, peanut oil, spices, and castor oil.

The import of rice averages $10,340,000 in value which is only approximately 4 per cent. of the value of local production. Locally produced rice commands a higher value than imported rice so that, by weight, roughly 93 per cent. of the total consumption is produced locally.

It is emphasised that the large annual foreign expenditure should be reduced by stimulation of home production and it is suggested that this is best attained by (a) protective tariff on rice, (b) prevention of manipulation by rice dealers, (c) better credit and transport facilities, and (d) improved cultural methods including use of fertilizers, selected seed, better irrigation, etc.

Maize imports average $770,000 whereas formerly local production practically supplied the demand. The decline in production is said to be due to soil exhaustion through erosion coupled with the prevalence of pests and diseases, and the author maintains that improvement in production should follow terracing of the lands to prevent erosion, better transportation facilities from producing areas, and better pest control.

Tobacco, chiefly as cigarettes, is imported annually to the value of over $4,400,000 despite excellent conditions for local production. The needs of this industry are intensive specialization, adequate capital, the production locally of wrapper tobacco, and propaganda to improve the market for local production.

Vegetables are imported annually to the tune of over $3,850,000, the chief articles being cabbage, garlic, onions, potatoes, and even sweet potatoes. It is suggested that more intensive cultivation, rigorous pest control, and the better preparation for market of locally grown vegetables should go far to reduce this import.

In 1929, over $3,630,000 worth of fruits, including peanuts, ($275,000) were imported. Local production could supply most of these fruits if orchards were given adequate care regarding selection of planting material, soil management, and pest control, particularly periodic spraying.

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* Manuel L. Roscas in the *Philippine Journal of Agriculture*, Vol. I, No. 3. 1930.

† In this Abstract, Straits currency is used throughout. $1 = 2s. 4.

Coffee and cocoa imports average $1,540,000 and $1,375,000 respectively in value annually, and these bills could be completely counteracted by increasing the planted areas where conditions are suitable and by better cultivation.

Spices and castor oil (pepper in particular) were imported in 1929 to the value of $216,700 although they could readily be grown locally. In this respect it is mentioned that $10,000,000 of pepper is imported into North America annually, and it is contended that part of this vast market might be obtained by Philippine produce grown on a large scale. The author summarises his article by emphasising the need for more intensive cultural methods, better preparation of products for market, and Government assistance in the marketing of new products.

THE COCONUT OIL INDUSTRY. *

In 1907, nearly 3,000,000 acres of coconuts were under cultivation, and, at the present time there are approximately 7,000,000 acres devoted to the cultivation of the palm, of which area more than one half is in the British Empire. India possesses the largest area under cultivation, but this is no indication of the amount of oil or copra exported from that country, as owing to religious scruples forbidding the use of animal fat as a food, a large proportion of the natives rely entirely on the locally produced vegetable oils.

Copra Production.

The splitting of coconuts is generally done by hand; although in some districts machinery is in use for this purpose, it is found to be not much quicker than native labour.

A brief description of sun drying and smoke kiln practice is given. It is stated that one British firm has recently supplied several copra drying machines for use abroad and that these plants have a capacity of 150 tons of nuts (? 75,000 nuts) a day.

The Expression of Coconut Oil.

Before the oil may be expressed from the copra, it has to be ground first to a coarse meal, after which it is further reduced by special rolls. The meal must not, however, be ground too finely otherwise the coconut oil produced will be cloudy and in the subsequent purification the working loss of oil will be high. A full account of grinding and disintegrating is given.

* The Coconut Oil Industry, A. E. Williams, 9.4.7., "Engineering" October 16th 1931, page 481.

Two types of oil press are fully described, the hydraulic press and the screw press, the latter being of special interest to small producers as the capital charges are not high. In this machine the oil is expressed by means of a rotating screw which exerts a gradually increasing pressure on the meal which passes through continuously.

The best yield of oil is obtained when careful attention is given to the cooking of the meal before expression. In the case of damp meal, surplus moisture must be evaporated and the meal cooked by means of dry steam. Very dry meal may however be heated by live steam.

Cattle meal :—The residual meal from the presses may contain from 5 to 9 per cent. of oil and is valued as a cattle foodstuff. Other materials are frequently incorporated before the meal is marketed.

The Uses of Coconut Oil.

Soap :—In combination with other oils and fats, coconut oil is largely used in the manufacture of soap. The special points in its favour are that it normally does not require bleaching before use, it produces a hard soap which is fairly soluble and which will lather particularly well, and it gives a higher yield of the by-product,—glycerine, than any other oil. At the present time coconut oil represents 12 per cent. of the oils used in soap-making in Great Britain and in America about 20 per cent.

Margarine :—In the manufacture of margarine, the special points in its favour are its melting point, its texture and its consistency. Experience has proved vegetable oil to be quite as satisfactory as animal fats for edible purposes except for their deficiency in vitamins which, in the best margarine factories, is corrected.

Recently, coconut oil has largely displaced cotton-seed oil in the American margarine industry. Coconut oil is used in 35 per cent of the margarine made in Great Britain while in America the figure is 50 per cent.

Confectionery :—Coconut oil also enters into the manufacture of chocolates, toffee and biscuit manufactures.

Reviews.

The Preparing for Market and Marketing of Tea.

Eighteenth Report of the Imperial Economic Committee. H. M. Stationery Office, London, 1931, 74 pp., price 8d., post free.

At a time when interest is directed to the potentialities of tea production in Malaya, both in the uplands and on the plains, this publication on tea is most opportune.

The Report gives a concise history of the growth of the tea growing industry and of the methods of marketing, tea-tasting and blending. But interesting as are these facts, they are moderately well known and are of much less value and significance in this place than are the sections which follow, which treat with questions of consumption, demand and supply, leading to a discussion on the restriction of out-put and to a most valuable seven pages on "Market Expansion". The last two sections discuss research and the conclusions of the Committee.

Doubtless those who embark on the development of land with tea will have satisfied themselves on the suitability of the land for this purpose, but the points on which they may still entertain doubts are on the questions of varieties of tea most profitable and on the future prospects of the tea industry. It is on these problems that this report throws considerable light and on account of which it is recommended to the reader.

At the time of the introduction of tea into Europe, the supplies came entirely from China, but in course of time, the development of the industry in India and Ceylon ousted China as a serious competitor in this market, although it is noted that China tea is still popular in the United States of America. At the present time, the British Empire produces about 70 per cent. of the world's supply and nearly 70 per cent. of it is consumed within the Empire. It is significant that the exports from China now amount to only 8 per cent. of the total world's supply.

> "Although no figures are available, the production of tea in China is believed to be very large, but it is principally a peasant production, grown in the immediate vicinity of the peasant's homestead, and gathered and prepared by his family. Failure to keep pace with the large scale production and the more scientific and more hygienic methods of machine manufacture on the plantations of India and Ceylon facilitated a general change of taste among consumers, and particularly in the United Kingdom".

But while we may so easily dismiss China as a rival to Empire-produced teas, a more serious competitor is to be found in the Netherlands East Indies, where the production has increased considerably and the quality of tea produced, although not good, has considerably improved of late. The principal areas under tea (in thousands of acres) are India 773, Ceylon 450, Java and Sumatra—including native holdings—371.

The next subject of importance is blending, and for this the services of the tea-taster are essential. One of the aims of the distributor is to stabilise the price of the tea. This is necessarily somewhat difficult with such a commodity as tea which is subject to violent fluctuations in price. Some measure of stability is therefore attained by the use of "fillers", tea of low quality which in times of high prices can be mixed with better grades without very apparent deterioration in appearance or flavour. It follows that in times of low prices the demand for the lower quality tea declines and therefore its value, for the distributor will then use a greater proportion of better quality leaf. The stabilisation of price has, in part, been also met by the introduction of the coupon or "gift" system, although this is looked upon with some disfavour as it tends to distract the attention of the consumer from the quality and price of the aritcle sold, to the attractiveness of the gift offered.

From the above, it will be seen that there is a surer and more stable market for the better quality teas. Tea drinkers are most discriminating and are generally prepared to pay for a good quality tea not only from the point of view of taste, but because they realise that such teas are more economical. It, therefore, behoves tea planters to aim at high quality tea and blenders to keep in touch with the trend of public taste.

It is a point worthy of note that the flavour of tea is very much controlled by the method of manufacture and is not, as is generally assumed, entirely a question of altitude.

It is definitely asserted that it is possible to obtain any blends of tea suitable for consumption in the United Kingdom entirely from Empire produced tea. This is, actually, an accomplished fact with certain large distributors, although insufficient advantage has so far been taken of the advertising value of Empire products by such distributors. The report favours the encouragement of blending by grocers and offers suggestions for encouraging voluntary declaration of origin of teas in the blend.

The stock position is studied in some detail. The general effect of the slump in tea in 1920 was the introduction of finer plucking, and this system was generally adhered to on estates in subsequent years of high prices. Native production, however, and supplies from the Netherlands East Indies have somewhat interfered with the good effects of this system and has, in fact, to some extent reduced the degree of success of the tea restriction scheme introduced in 1930. The report's final comment on tea restriction provides the key for the subsequent sections on prices and the future of the industry. On the subject of restriction, the report states—

> "At the best, it is a palliative, not a cure, and the continued prosperity of the tea industry as a whole depends on increased consumption and the development of greater world markets".

A consideration of the statistics of the *per capita* tea consumption in 36 countries, comprising practically all Europe, America, Australia and part of Africa, amply bears out the above contention.

The United Kingdom is the principal tea consumer, the annual consumption per head being 9.20 lbs. It is thought that there is still room for expansion on this market although the annual increase must necessarily be at a slower rate than during the past 10 or 20 years. If this be true of the United Kingdom, what can be said of the United States of America, when the *per capita* consumption is only .75 lb. per head? An account is given of the attempts so far made to increase the consumption of tea in the U.S.A. and valuable suggestions are advanced for future efforts in this direction.

Among other countries of importance Russia is given particular notice on account of her deep-seated tea drinking habits and vast population. Before the Revolution, Russia was the second largest importer of tea in the world. She still ranks as the third largest importer.

> "In 1927-28 the total imports of tea into Russia were 65 million lbs. in contrast with 172 millions in 1914—a drop to little over one-third of the old figure, though, even so, it shewed an increase of 34 per cent. on the figures for 1926-27....."
>
> "Under-consumption in Russia is one of the principal factors in the present situation. Were Russia able to purchase tea on the pre-war scale there would be no surplus and no talk of 'over-production'. The difference between the present and pre-war import into Russia is more than 100 million lbs.—or nearly twice the amount of reduction sought under the restriction scheme".

It is impossible to forecast the future development of the Russian market. The Russians themselves are attempting to develop their own supply. Under the Five Year Plan the estimated production of tea in Russia is 500,000 lbs. in 1929, rising to 46,000,000 lbs. in 1940. Even if these estimates are realised there remains a considerable gap between their production and the actual pre-war figure of imports. It is possible that this difference may be filled by imports of tea from the British Empire if suitable arrangements can be made regarding credit.

The report, however, looks less on foreign markets for the solution of the present difficulties of the tea industry than on the possibilities of increasing consumption in the Empire. "The market at India's own door may yet prove the answer to the problems of the industry". Considerable success has attended the work of the India Tea Cess Committee towards encouraging the consumption of tea in India.

Tea production is not only increasing in India, Ceylon and the Netherlands East Indies, but is developing in the Union of South Africa, Nyassaland, Kenya and Malaya. The report urges that every effort should be made to develop the consumption of tea in these countries of production, pointing out that those engaged in the local production of tea are best placed for encouraging local consumption.

The penultimate section of the report discusses the present position of research and advises on its future development. In the first place, it is urged

that there should not be too rigid a specilisation on pathological research to the neglect of crop production and general husbandry. Further, closer co-operation between planters and research workers should be attained. "It is the actual application of research to industry which presents the greatest difficulties, and these can be overcome by co-operation and organisation".

The report also urges that there should be closer contact between the tea research in India and Ceylon and points to the need of closer contact between research workers and the London market.

Among the recommendations of great value is that for closer attention to the improvement of planting material and the inauguration of Government nurseries for the supply of first-class planting material at reasonable rates.

To sum up, the Imperial Economic Committee does not appear to look upon the future of the tea industry as hopeless, but as demanding, firstly, the maintenance of high grade tea production in the Empire—pointing out that the world's finest teas are grown in the British Empire; and secondly, propaganda and other means of stimulating the consumption of tea primarily in the country of production, then within the British Empire and finally in other countries.

There is much information in this report of great value to the infant tea industry of Malaya. This publication should indeed be widely read throughout the world. It is not only an informative document on this subject, but one of great value from a publicity point of view, pointing out the pre-eminence of British Empire tea and encouraging its consumption by reason of its purity and the great care taken in its production and marketing.

D. H. G.

Transport of Mangosteens by Sea.

Report on a Further Experimental Consignment of Mangosteens from Burma, 1931. Empire Marketing Board Experimental Consignments Report No. 10, 8 pp.

This report deals with the third attempt to transport mangosteens by sea from Burma to the United Kingdom, the two previous attempts being in 1929 and 1930.

In the present instance, the fruit was packed in flat boxes, each containing 50 fruits. It was in cold storage on the voyage of 33 days at a temperature of about 60°F. The value of the experiment is somewhat vitiated by lack of data of the temperature on the voyage, a point which is fully realised by the writer of the report. It was intended that the temperature should be maintained at 50°—55°F.

The boxes of mangosteens were packed in two conditions of ripeness, *viz*: almost ripe and just ripening. Wastage was slightly greater in the more mature fruit, the average wastage of "untreated" fruit being 54 per cent. for the "almost ripe" and 49 per cent. for the "just ripening".

Mangosteens were also "treated" by dipping in rubber latex. It was found that there was no material difference between the wastage of fruit so treated and untreated fruit. The former, however, retained its fresh appearance.

The Report states that "little difference could be noted between fruit that had been once dipped in rubber latex and the 'twice-dipped' fruit, although the latter was perhaps preferable in that the thicker membrane could be more easily removed". Actually a difference in loss of weight during shipment is to be observed, which in itself, one would imagine, would influence the attractiveness of the fruit and also its flavour. The actual percentage loss of weights are as follows :—

Almost ripe Once dipped 11.4 per cent. Twice dipped 8.6. per cent.
Untreated 13.7 per cent.

Just ripening Once dipped 10.4 per cent. Twice dipped 9.5 per cent.
Untreated 13.9 per cent.

While dipping the fruit in latex was effective in preserving the fresh appearance, it appeared to have no effect on wastage. The Report continues :—

> "Whether the treatment (i.e. dipping in latex) is to be recommended for commercial consignments is doubtful. The primary object of the present experiment was to ascertain if a fairly thick latex coating would reduce hardening of the skin. It now appears, however, that it is possible to ship untreated mangosteens without undue hardening or shrivelling provided the carrying temperature is suitable and the fruit sufficiently ripe, so that for this purpose the latex membrane is unnecessary".

Other possible objections to latex treatment are stated to be labour, expense, delay in packing, and prejudice in the trade and among consumers.

The wastage of the fruit was found to be due to a fungus—Diplodia,—which is thought to be largely preventable by the adoption of precautions in the orchard. It is, however, quite possible that Diplodia infection occurs not only in the orchard, but at any stage before chilling. Given freedom from Diplodia infection, it is the Reviewer's opinion that further experiments with latex covered fruit would be justified on account of its superior appearance on arrival. Once it is definitely proven that latex-covered fruit is superior in any respect to untreated fruit, there appears no reason why the technique of dipping and packing should not be improved with a consequent lowering of costs. It is unlikely that the prejudices of the trade or consumer will react against the dipping of fruit. The public look with favour on any process which shows them that the product is being packed with the greatest care possible, while the removal of the latex covering offers no objectionable features.

D. H. G.

Imperial Agricultural Bureaux, Second Annual Report of the Executive Council 1930—1931.

H. M. Stationery Office, 12 pp., price 1s. 0d. net.

In the issue of this second annual report, the Executive Council gives evidence of the increasing usefulness to research workers of the eight Bureaux which were founded on contributions from the Governments of the Empire.

The close association between the Bureaux and research workers generally has been stressed as an aim of this scheme. This contact is being achieved not only by the distribution of printed information, but by correspondence and personal meetings between the Bureaux and the actual workers.

During the year under review, three special conferences were organised in connection with three of the Bureaux—Soil Science, Animal Health and Fruit Production which were well attended by research workers both in the United Kingdom and the Empire overseas. A restricted number of tours were made by officers of the Bureaux which enabled closer touch to be maintained with workers on particular problems.

The need of published abstracts has been realised by the Bureaux, for the mass of literature is now so great and so scattered that without the aid of a "central clearing house" such as is provided by the Bureaux it is difficult for the research worker to be cognisant with the advances made by other workers which have a bearing on his own work. Arrangements were, therefore, made whereby the preparation and issue of journals of abstracts or extended titles connected with each of the eight Bureaux would be undertaken. A list of journals issued is given, some of which have been noted in the pages of the *Malayan Agricultural Journal.*

One of the most interesting and important decisions of the Council is concerned with the issue of an abstracting journal on questions of Nutrition. The need of such publication has been long felt, while the importance of the subject is more keenly realised than ever before. As much of this nutrition work is common to workers whose chief interests may be concerned either with humans or with animals, co-operation has been attained between the Imperial Bureau of Animal Nutrition and the General Medical Research Council, with the result that we are promised an abstracting journal on Nutrition which will deal with both aspects of the subject.*

Towards the achievement of its object of the collection and dissemination of information on research work accomplished or in progress, the Bureaux have made notable advances during the year, with the result that the organisation work carried on during this period will undoubtedly be brought to fruition in 1931-32.

D. H. G.

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* The first two numbers of *Nutrition Abstracts and Reviews* have now come to hand. They contain 1334 abstracts or reviews.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

Fourth Quarter, 1931

BY

G. H. CORBETT.

Insect Pests in Golf Greens.

Information was sought in June, 1931, as to the control of insects damaging the grass of golf greens. A caterpillar (unidentified) was found to be the cause of the trouble. A "tuba" spray was recommended, but possibly owing to the wet weather then prevailing, it was not effective in controlling the caterpillar. Subsequently, experiments were conducted in order to ascertain at what strength lead arsenate could be safely employed without causing injury to the grass. Several strengths of lead arsenate (powder) were used and spraying was repeated weekly for eight weeks when the experiments were concluded. It was found that lead arsenate at all strengths, the weakest being at the rate of ½ lb. to 50 gallons of water, controlled the caterpillars, but that strengths stronger than 2 lbs. to 50 gallons of water were inclined to cause burning. As a result of these experiments, 1½ lbs. to 50 gallons of water is considered the most satisfactory strength of lead arsenate to use for the control of this caterpillar on golf greens.

In addition to the immediate control for this caterpillar, series of experiments were conducted on top-dressing the greens with soil and lead arsenate and other series on growing Bermuda grass in poisoned soil.

In the top-dressing series, lead arsenate was applied in varying amounts up to 2,420 lbs. per acre. With this amount, the grass was conspicuously burnt, but at the rate of 600—900 lbs. per acre no burning ensued.

In the poisoned soil experiments, Bermuda grass was planted in plots of lead arsenate poisoned soil at rates varying between 302 lbs. to 2,420 lbs. per acre. In all these plots, the Bermuda grass became satisfactorily established. Although slight differences were noticeable during the first two months or so, its growth in all the experiments was satisfactory and compared very favourably with the growth of grass in unpoisoned soil. On the whole, the Bermuda grass growing in a plot poisoned with lead arsenate at the rate of 1,512 lbs. per acre had possibly the best appearance.

The details of these experiments will be published in due course, but the results show that lead arsenate at the rate of 1½ lbs. to 50 gallons of water will control caterpillars damaging the grass of golf greens, that top-dressings poisoned with lead arsenate at the rate of 600—900 lbs. per acre cause no burning and will prevent immediate injury by caterpillars and that Bermuda grass will grow satisfactorily in soil poisoned with lead arsenate at the rate of 1,512 lbs. per acre.

It may be mentioned that damage to the roots by grubs, caterpillars and

"white ants" burrowing under the soil may be prevented in due time by top-dressings which will eventually become incorporated in the subsoil and that greens may be rendered insect proof for a considerable time if they be laid down with soil which has been poisoned with lead arsenate.

Rubber.

An unusual outbreak of grubs damaging the roots of mature rubber has recently come under observation. The grubs, which are typical chafer grubs, do not confine their attention to the rootlets but have been observed practically entirely de-barking the lateral and tap roots. The area over which these grubs are numerous is possibly not more than 80 acres and is enclosed entirely on three sides by jungle. The area is completely clean-weeded and no other alternative food-plant than the roots of rubber is available to the grubs. The records appear to show that the beetles (*Leucopholis* sp.) commence to emerge from pupae in the soil about the end of December and continue until April. The generations undoubtedly over-lap. At the present time, grubs, pupae and adults may be found in the soil and adults have been caught on the wing.

Several experiments are in progress for the control of this beetle. Three species of Scoliid wasps have been found to be active parasites on the grub.

Coffee.

In Entomological Notes for the Third Quarter, 1931, attention was drawn to the desirability of not introducing coffee berries for planting purposes unless certified free from coffee berry beetle borer. During the past quarter, the writer visited Cameron Highlands in order to ascertain if the coffee berry beetle borer (*Cryphalus hampei*) was present. After very careful examination of the coffee areas no indication of the presence of the coffee berry beetle borer at Cameron Highlands was traced. Before contemplating introducing coffee berries for planting purposes to the Highlands from the Lowlands, it would be advisable and very desirable to send all such seed for examination and if necessary for treatment before running the risk of introducing this most serious pest of coffee to the Highlands.

Coconuts.

The caterpillars of *Telicota palmarum* Mre. are only very occasionally collected from the coconut palm. In October, however, they were recorded in considerable numbers on young palms on an estate in Perak. In addition, *Hidari irava* Mr. and *Amathusia phidippus* L. were also reported towards the end of December. Whilst *Hidari irava* is most generally confined to small areas, *Amathusia phidippus* is more scattered. *Amathusia* in this instance seems to be checked by a Chalcid parasite, as many as 27 having emerged from one chrysalis.

Departmental.

FROM THE DISTRICTS.

The Weather.

The December rainfall appears to have been above average in most parts of the Peninsula excepting along a strip of the Negri Sembilan—Selangor coast. In many instances, very heavy downpours were experienced in the first half of the month which occasioned flooding of the Perak and Pahang rivers. From the reports so far received it is believed that the floods in Perak did less damage to crops than was at first feared. The same would appear to apply to Pahang, although full reports are not yet available from Perak and practically no information has been received from East Pahang.

Remarks on Crops.

Rubber.—Price quotations for small-holders' rubber are slightly above those which prevailed during November, ranging, in dollars per picul, from 8—14.50 for smoked sheet and 7—14 for unsmoked sheet as compared with Penang quotations of 12.25—13.80 for smoked sheet and from 9—13 for unsmoked sheet.

The position with regard to Mouldy Rot is similar to that reported last month. The wet weather resulted in great activity of the fungus, but in most instances painting with fungicides is preventing excessive damage to the renewing bark except in the very worst cases. It is reported from Province Wellesley that a slight rise in price resulted in increased tapping activity. No further change is reported regarding the area of small holdings in tapping.

Padi.—At the time of writing, no detailed information can be given with regard to the damage done to this crop by the floods in Perak and Pahang. Certain areas in Kuala Kangsar District were submerged to a depth of six feet or more, but when the water had subsided it was found that the crop had sustained little damage. Similarly, only slight damage is reported from Raub and Bentong Districts in Pahang. The position in Pahang East is not yet known.

In Selangor and in some parts of West Pahang, where harvesting was in progress, loss of the crop has been caused by the inclement weather. From all other parts of the country prospects are reported to be good. Harvesting has commenced in some parts of Kedah and Province Wellesley, and in Malacca and Negri Sembilan.

Tobacco.—Cultivation of tobacco in Kedah is extending to the Kulim and Bunda Bahru Districts where 35 acres have been planted. During the month 120 piculs of locally grown leaf was sold in Bukit Mertajam and Penang, prices ranging from $15 to $35 according to quality. In the Dagong area in South Perak some damage has been done by floods. In Selangor, fresh areas have been planted up at Sungei Buloh by Chinese as the result of successful trials made by the Chinese headman of the locality.

Rat Control in Padi Fields.—From Krian a certain amount of scattered damage is reported and heavy damage has occurred along the nothern boundary of Bagan Tiang mukim as a result of planting operations in the Province, which disturbed the rodents there and caused a migration over the border.

Agricultural Stations and Padi Test Plots.

KEDAH. *Telok Chengai Rice Station.* Most of the short-season varieties have commenced to flower. A certain amount of spotting of the leaves occurred on long-season varieties, but the plants improved after heavy rains towards the end of the month.

Padi Test Stations.—Good growth was made by the plants at Jitra, Langgar and Rantau Panjang, but at Sala Kanan Plot deep water has resulted in some uneven growth.

Agricultural Station, Gajah Mati. The cover-crops *Calapogonium* and *Centrosema* have germinated fairly well and supplying and weeding were commenced.

PROVINCE WELLESLEY. *Glugor Padi Test Station.* Weeding of the whole Station was completed during the month. Rat damage has occurred in the long-season varieties to such an extent that reliable results from the experiments will not be possible. The short-season varieties have not suffered in this manner.

Bukit Merah Test Station. The padi has a healthy and pleasing appearance excepting in one plot where damage was done by *Sogata furcifera.* Flowering has commenced. Rain gauges were installed on both of these test plots during the month.

PERAK. (a) *Agricultural Station, Selama.* The erection of the fence and store was completed. Budded kapok was planted around the boundary and four varieties of bananas, a plot of pepper and two varieties of pineapples were planted.

Kuala Kangsar. A small crop of oranges is nearly ready for gathering. Seedlings of a Rangoon type of tobacco have been pricked out prior to planting. The Chinese tobacco planted last month sustained damage as a result of heavy rain. The rambutan seedlings have been transferred to bamboo pots to facilitate handling. Groundnuts have been sown and yams are being harvested.

(b) *Padi Stations and Test Plots, Talang.* On the 20th the whole Station was flooded to a depth of 5 or 6 feet and remained in this condition for 2 days. Notwithstanding this experience, the plants appear to have sustained little damage except in small portions of the Seraup area where a certain amount of wash took place as the water subsided. The banana manurial experimental area was planted up early in the month.

Lenggong. This Station was also flooded with very little apparent damage. Flowerings has commenced.

Bruas. Water difficulties were encountered as a result of a broken dam due to heavy rains. The plants still show uneven growth.

Bukit Gantang. A certain amount of rat damage has been sustained,

Flowering commenced on the local radin, S. 741 and N. 24 varieties.

Kamunting. Tri-weekly liberations of parasites have been continued, but stem-borers appear to be causing some damage. At the end of the month flowering had commenced over the whole Station.

Selinsing. Stem borer counts indicate an infestation of 11.73 per cent. A little rat damage has been done but, on the whole, plants are in good condition.

SELANGOR. *Cheras Agricultural Station.* The higher land reserved for permanent crops has been lined and holed ready for planting. The construction of the main access road was finished and 5 inspection paths completed. Fence erection was completed and the borders of the roads and paths were planted with carpet grass. Plans of the market gardeners' house and of the shed have been approved and work on their erection will be commenced without further delay.

Kajang Test Plots. The varieties Radin 2 and 13 were harvested during the month. Much damage was done by pests as all the surrounding padi has been harvested.

Kuang Test Plot. Harvesting is nearly completed. The operation suffered interference on several occasions from rain which resulted in some loss of grain.

NEGRI SEMBILAN. (a) *Agricultural Station, Seremban.* Yams were harvested and the citrus trees sprayed with kerosene and soap emulsion.

Rembau. Fencing, gates, roads, well and propagating house were completed. The quarters and cooly lines were also completed and handed over by the Executive Engineer and occupied by the staff. Areas for clove, nutmeg and citrus have been lined ready for planting. Pepper plants were planted.

Rembau Padi Test Plots. Flowering has commenced on a few plots.

PAHANG. (a) *Agricultural Stations, Lipis.* The citrus area was supplied with marcots. Maize and tobacco were sown and tapioca and tobacco is being harvested.

Temerloh. Buildings, fences and gates are now completed. The Station was under about 11 feet of water during the floods.

(b) *Padi Test Plot, Dong.* This Plot escaped floods. Flowering has commenced. Some varieties are rather badly lodged.

Temerloh. Floods did much damage to the crop and some of the plots have been completely destroyed.

Pahang East. No information is as yet available regarding the Agricultural Stations and Padi Test Plots in Pahang East.

MALACCA. *Agricultural Station, Sungei Udang.* Plantings were made of two varieties of pineapple, kapok and rambutan and chiku marcots. Further progress was made with the buildings.

Pulau Gadong Rice Station. All padi has flowered and harvesting of the earliest varieties has commenced. The Italian strains of padi flowered within three weeks of transplanting.

DEPARTMENTAL NOTES.

Tours of the Acting Director of Agriculture.

The Acting Director of Agriculture paid an advisory visit to two coconut estates in the Bagan Datoh district of Perak on 7th. and 8th. December, 1931. He then proceeded to Cameron Highlands where three days were spent in inspecting the Government Experimental Plantation at Tanah Rata and other work in progress.

Government Dairy and Poultry Farm, Fraser's Hill.

The attention of visitors to Fraser's Hill is drawn to the existence of the Government Dairy and Poultry Farm at Jeriau, which is run under the control of the Department of Agriculture, S.S. and F.M.S., with a view to providing the public with supplies of fresh milk, poultry and eggs.

Milk.—The dairy herd at Jeriau comprises 25 pure-bred Friesian cows imported from South Africa and several pure-bred Jersey cows imported from Australia. All the imported animals passed the tuberculin test to show that they were free from bovine tuberculosis at the time of export.

The dairy farm is run under European supervision and every attention is given to the cleanliness of the milk supply, while all milking utensils and bottles are regularly sterilised with steam. Further, the milk is periodically tested by the Institute for Medical Research and the tests show that it is above the standard required for Grade A milk.

The milk is bottled at the Government Dairy adjoining the Post Office and is ready for distribution in bottles at about 7 a.m. and 3 p.m. Each bottle is capped with a printed disc bearing the name of the farm so as to prevent contamination.

The price of the milk is 25 cents per pint in returnable bottles and there is no necessity to place a regular order as there are ample supplies to meet the irregular demand of visitors to the Hill.

Facilities have also been arranged for the sale of milk at the Dairy at 10 cents per glass, when consumed on the premises.

Poultry and Eggs.—The poultry farm is also run on modern lines and includes a flock of pure-bred Rhode Island Red, White Leghorn and Light Sussex fowls imported from South Africa.

Supplies of eggs are on sale at the Dairy at 5 cents each for grade A (large) and 4 cents each for grade B (small).

Sittings of eggs of the pure-bred fowls can be obtained when available at a cost of $3 for 12 eggs, without replacements.

As the farm develops, regular supplies of specially fattened birds will be available for sale at the Dairy.

Vegetables.—A large area at Jeriau is devoted to the cultivation of vegetables under strict European supervision and supplies of fresh vegetables can be obtained daily at the Dairy.

Visitors leaving the Hill can obtain baskets of vegetables to take down with them by placing an order on the day before departure at the Government Dairy adjoining the Post Office.

Order.—All orders and enquiries should be addressed to the Manager, Dairy Farm, Fraser's Hill ('Phone—Fraser's Hill No. 29).

Vacation at School of Agriculture, Malaya.

The School term concluded on 21st. December, 1931. The next term commences on 16th January, 1932.

Staff Changes.

Mr. E. A. Curtler, Assistant Agriculturist, took charge of the Government Plantation, Cameron Highlands, on 13th November, 1931.

Mr. J. Fairweather, Agricultural Field Officer, has assumed the duties of Agricultural Field Officer, Johore North, and is stationed at Muar.

Under the reorganisation scheme of the Department, Mr. A. E. Coleman-Doscas is acting as Senior Agricultural Officer, Perak, and is stationed at Taiping. Mr. F. Birkinshaw, who holds this substantive appointment, is acting as Chief Agricultural Field Officer.

Statistical.

MARKET PRICES.

December, 1931.

The continued weakness in Sterling has been reflected in enhanced prices for several articles. The Homeward Conference announce a further increase in freight rates with the sole exception of rubber. Pepper, tin, rattans and Illipenuts have been subjected to drastic increases, varying from 18 per cent. to 30 per cent., and this action is the subject of a protest from Merchants to the Conference. Other rates have been increased by 10 per cent. (*Singapore Chamber of Commerce Market Report.*)

Markets generally have been quiet, with only a limited amount of business passing.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 9.92 cents per lb. in December, the average London price being 3d. per lb. The prices in November were 8.75 cents and 3d. respectively.

Palm Oil.—The price at the beginning of the month was £21 rising during the second week to £21.10.0. Thereafter the price reverted to £21. The market closes steady. The above prices are C.I.F. Liverpool on a basis of 18 per cent. free fatty acids.

Copra.—Supplies have been small so that quotations have firmed up slightly. The average Singapore price in December for Sundried was $5.71 per picul, as compared with $5.50 in November. Mixed copra averaged $5.09 per picul as compared with $4.83 in November.

Coconut Oil.—The average wholesale export price of coconut oil during December was $9.50 per picul. Copra cake was quoted throughout the month at $2.20 per picul.

Gambier.—The nominal prices for Block gambier improved from $12 to $15 per picul, the average for the month being $13.20 per picul. Cube No. 1 improved from $22 to $24 per picul, the average Singapore price for December being $23 per picul, as compared with $21.62 for November.

Rice.—The average wholesale price of Siam No. 2 ordinary rice in November was $4.21 per picul, as compared with $4.70 in October. The retail market prices in November in cents per gantang of No. 2 Siam rice were Singapore 32, Penang 35, Malacca 27 as compared wit 33, 34 and 28 respectively in October.

Arecanuts.—Palembang arecanuts averaged $4.22 per picul and Bila Whole $4.30 as compared with $4.46 and $4.61 respectively in November. Being the end of the season there were no stocks of Kelantan Splits. For other grades the average prices in December were as follows:—Sliced, $9 to $11.31; Split, $4.61 to $6.06; Red Whole, $7 to $7.50—all per picul, the price within each range depending upon quality.

Coffee.—The demand has been very small. Java Robusta averaged $18.37 to $21.50 per picul, the price within these limits depending upon quality

Corresponding prices for November were $16.25 to $17.88. Palembang coffee averaged $15.62 per picul in December, as compared with $13.25 in November.

Pineapples.—Until the last week of the month this market has been very active with considerable business passing at quotations. Buyers now appear to have filled requirements for the time being. With Packers fairly heavily over sold however, the market, continues steady. Cubes 1½ lb. advanced by 25 cents to $4 a case, the average price for the month being $3.90. 1½ lb. Sliced flat advanced 18 cents to $3.60 per case, the December average being $3.51½ per case, while the nominal prices quoted for 1½ lb. Sliced tall improved by 30 cents per case to $3.75, the average for the month being $3.61 per case nominal.

Tapioca.—Prices have remained steady. Average prices for December were :—Flake, fair, $3.33 per picul; Pearl, seed, $4.50 per picul, Medium, $4.75 per picul.

Sago.—The market has been quiet with little business passing. Prices sagged during the later part of the month. Average prices for December were :—Pearl, small fair, $4.85 per picul; Flour, Sarawak fair, $3.20 per picul.

Nutmegs.—There has been but small enquiry during December and prices were as follows :—110 per lb., $28.50 per picul, 80 per lb., $36.30 per picul

Mace.—Has followed the trend of nutmegs. Average December prices in Singapore :—Siouw, $65 per picul; Amboina $52.40 per picul.

Pepper.—Prices have shewn some fluctuations and close easier. Singapore average prices for December were :—Singapore Black, $23.80 per picul; Singapore White, $32.20 per picul; Muntok, White, $33.20 per picul.

Cloves.—Nominal prices only are recorded for the Singapore market. Zanzibar averaged $49.60 per picul nominal; Amboina $54 per picul nominal.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Cumberbatch & Co. Ltd., Kuala Lumpur; the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY. *

November, 1931

Malaya.—Total foreign imports of rice for November 1931 amounted to 50,109 tons, as compared with 54,216 tons for the same month last year, of which 54 per cent. were into Singapore, 25 per cent. into Penang, 4 per cent. into Malacca, 12 per cent. into the Federated Malay States and 5 per cent. into the Unfederated Malay States.

Of these imports, 52 per cent. were from Siam, 44 per cent. from Burma, 3 per cent. from French Indo-China and 1 per cent. from other countries.

Gross foreign imports of rice into Malaya for the 11 months, January to November, 1931, were 637,733 tons as compared with 716,884 tons in 1930, a fall of 11 per cent. Net imports were 480,970 tons as compared with 530,439 tons in 1930, a fall of 9.3 per cent.

Total foreign exports of rice in November 1931 were 15,815 tons as compared with 16,348 tons for November 1930.

The stocks of padi and rice held by principal dealers, millers and estates in the Straits Settlements, Federated Malay States, and Johore at the end of October amounted to the equivalent of 57,124 tons of rice, as compared with 52,589 tons the previous month.

The imports of rice from all sources during October 1931 were—F.M.S. 19,085 tons, Johore 6,547 tons, Trengganu 2,103 tons, Kelantan 845 tons, Kedah 2,862 tons.

Padi reports indicate that work for the new season 1931—2 is in hand in all areas.

As we go to Press (28.12.31) reports are to hand that owing to the very heavy continuous rains in Pahang, much standing padi has been destroyed. The extent of the damage cannot at present be ascertained.

India.—The Second Forecast of the rice crop in Burma for the season 1931—2 issued on November 14, 1931, gives the area likely to mature as 12,258,000 acres, being 2.8 per cent. less than the final figures of last year. The Forecast states that the crop generally was good in Lower Burma and much improved by the September and October rains in Upper Burma.

Burma exports of rice and rice products (including exports to India) from January 1 to November 28, 1931 were 3,290,765 tons, an increase of 0.6 per cent. over that of the corresponding period of 1930.

Japan.—The 1931 rice production in Japan (Proper) is reliably reported at 7,717,800 tons, a decrease of 17.7 per cent. as compared with 1930. Stocks of rice in Japan (Proper) on November 1, 1931 were—according to *The Trans-Pacific Journal* dated November 19th, 1931—1,281,940 tons, an increase of 59.8 per cent. as compared with 1930. It is also stated that owing to the poor rice

* The following is an abstract of the General Rice Summary for November 1931, compiled from various sources by the Registrar-General of Statistics, S.S.

crop this year, it is likely to be necessary to import 701,000 tons to meet the requirements of the country.

Formosa.—The area under rice and the crop produced for the second rice crop this year have been estimated at 887,888 acres and 586,740 tons, being increases of 3.6 per cent. and 7.6 per cent. respectively as compared with 1930.

Siam.—Deliveries of padi at the Bangkok mills for the eleven months ending October 31, 1931 were 887,204 tons, an increase of 7.8 per cent. as compared with 1929—30 and a decrease of 20 per cent. as compared with the average of the past five years.

Exports from Bangkok for the same period were 1,088,812 tons, an increase of 10.9 per cent. as compared with 1929—30 and a decrease of 12.7 per cent. as compared with the average of the previous five years.

At the end of October 1931 the area under padi in 310 districts was reported to be 6,348,266 acres, a decrease of 4.3 per cent. as compared with the previous year. It is also reported that the total exportable surplus on November 1, 1931, amounted to 303,200 tons of rice.

Netherlands East Indies.—The total rice land is estimated at 9,750,936 acres as compared with 9,600,504 acres last year.

At the end of October 1931, the area harvested amounted to 8,263,610 acres, damaged to 416,267 acres and standing to 1,071,079 acres.

Imports into Java and Madura, January to October 1931, were 243,751 tons, as compared with 228,144 tons in 1930, and into the Outer Provinces, January to September were 246,492 tons as compared with 283,259 tons in 1930.

French Indo-China.—Entries of padi at the port of Cholon for the eleven months ending November 30, 1931 were 1,030,746 metric tons, a decrease of 87,242 tons (7.8 per cent.) as compared with 1930.

Exports of rice from Saigon for the eleven months ending November 30, 1931 were 897,561 metric tons, a decrease of 117,393 tons (11.6 per cent.) as compared with the previous year.

It is reported that by a decree published in the Journal Official under date of November 10, 1931, and promulgated in Indo-China on November 12, 1931, a considerable reduction has been made in the amount of export duty payable on all forms of rice.

Ceylon.—Imports for 10 months ending October 31, 1931, were 366,984 tons, a decrease of 20,731 tons (5.3 per cent.) as compared with 1930, and a decrease of 15,680 tons (4.1 per cent.) as compared with the average of the past five years.

Europe.—To Europe, period January 1 to November 12, 1931, the shipments of rice from the East were 993,822 tons, an increase of 49.1 per cent. as compared with 1930.

To the Levant, period January 1 to October 9, 1931, the shipments were 36,210 tons, an increase over 1930 of 180.7 per cent.

To the West Indies, period January 1 to September 27, 1931, the shipments were 127,373 tons, a decrease of 29.5 per cent. as compared with the same period of 1930.

AREAS OF PRODUCTIVE RUBBER UNTAPPED IN F.M.S. AND S.S. NOVEMBER, 1931.

(Estates of 100 acres and over).

Territory	Tappable Area out of Tapping		Total area Untapped*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres.	Acres.	Acres.
Perak ...	8,252	27,505	35,757
Selangor ...	11,334	39,356	50,690
Negri Sembilan ...	16,201	21,358	37,559
Pahang ...	7,190	4,191	11,381
Total F.M.S. ...	42,977	92,410	135,387
Province Wellesley ...	3,166	7,739	10,905
Dindings ...	217	1,659	1,876
Malacca ...	4,760	17,328	22,088
Penang ...	747	115	862
Singapore ...	10,612	5,198	15,810
Total S.S. ...	19,502	32,039	51,541
Grand Total ... (S.S. & F.M.S.)	62,479	124,449	186,928

*Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. & S.S. during November (not included in the above figures) were:—F.M.S. 42,465 acres, S.S. 11,402 acres, Total 53,867 acres.

PRODUCTIVE RUBBER UNTAPPED IN THE UNFEDERATED MALAY STATES, NOVEMBER, 1931.

State	Productive Area Untapped (Acres)		Total area untapped (Acres) (c)
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Johore ...	21,723	46,779	68,502
Kedah (a) ...	14,298	15,445	29,743
Kelantan ...	6,700	999	7,699
Trengganu (b) ...	nil	nil	nil
Perlis ...	308	156	464
Total U.M.S. ...	43,029	63,379	106,408

(a) Registered companies only and are rendered quarterly, commencing with June, 1931.

(b) Registered companies only.

(c) Areas rested due to rotational tapping system are not included in this table. The acreage untapped owing to rotational tapping system were Johore 32,773 acres, Kedah 42,769 acres, Kelantan 1,200 acres, Trengganu 1,394 acres: Total 78,136 acres.

MALAYAN AGRICULTURAL EXPORTS. OCTOBER, 1931.

Product	Net Exports in Tons				
	1930	Jan. 1—Sept. 30th 1930	Jan. 1—Sept. 30th 1931	October 1930	October 1931
Coconuts, fresh ...	10,475	7,854	6,166	1,200	927
Copra ...	102,014	66,507	70,828	15,311	8,752
Coconut Oil ...	9,475	7,267	7,412	738	717
Palm Oil ...	3,211	2,165	2,754	433	711
Palm kernels ...	485	320	411	85	143
Pineapples, canned	57,689	46,965	47,116	1,766	2,011
Tapioca ...	31,195	23,512	21,941	2,929	2,033
Arecanuts ...	23,254	18,548	14,767	1,541	1,319
Tuba root ...	55½	—	49½	6	3½

CORRIGENDUM

Oil Palm Acreage, Malaya, 1930.

With reference to the Annual Report of the Director of Agriculture, S.S. and F.M.S., for the year 1930 published in the supplement to the Gazette of July 17, 1931, substitute the following figures appearing under the heading "Oil Palm" on page 9 of the Report.

	Mature	Immature	Total
Federated Malay States—			
Perak ...	2,144	15,021	17,165
Selangor ...	10,446	2,515	12,961
Negri Sembilan ...	504	270	774
Pahang ...	—	788	788
Total F.M.S. ...	13,094	18,594	31,688
Straits Settlements ...		NIL	
Unfederated Malay States—			
Johore ...	5,064	12,703	17,767
Grand Total ...	18,158	31,297	49,455

F.M.S. Government Gazette Notification No. 248. Gazette No. 1 of 2nd. January, 1932.

Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex, for the month of November, 1931, in Dry Tons.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,056	11,964	11,848	120,130	10,263	96,181	Nil	Nil	Nil	Nil	14,673	4,229	147,580	78,093	...	14,251	12,952
Johore	...	2,318	3,630	4,018	39,635	3,464	41,392	Nil	10	Nil	32	908	6,286	9,046	72,613	...	2,392	3,854
Kedah	...	425	2,173	2,647	23,841	1,207	11,768	Nil	Nil	Nil	Nil	629	2,845	6,813	28,867	...	514	2,464
Perlis	...	25	6	6	72	19	120	Nil	Nil	Nil	Nil	Nil	21	Nil	178	...	28	7
Kelantan ...	...	210	108	216	1,977	92	3,908	21	Nil	107	Nil	22	410	730	5,461	...	153	82
Trengganu ...	..	55	50	97	1,135	48	567	Nil	Nil	Nil	Nil	Nil	145	Nil	1,702	..	55	50
Total Malay States	...	15,089	17,931	18,832	195,700	15,093	153,936	21	10	107	32	16,232	13,936	164,169	186,914	...	17,393	19,389
STRAITS SETTLEMENTS																		
Malacca ...	...	2,688	1,364	1,459	14,159			Nil		Nil		4,653		48,903		...	3,243	1,421
Province Wellesley	...	109	578	525	5,150	(2)	(2)	Nil		Nil						...	102	596
Dindings ...	...	105	134	95	1,057	2,414	22,898	Nil	13,977	Nil	187379	5,739	Nil	66,154	Nil	...	127	83
Penang	2,109	4,279	9	11	86			677		6,548						714	5,173	9
Singapore ...	9,516	32,316	279	183	1,944			7,089		86,407		21,388		204,623		3,431	32,727	302
Total Straits Settlements	11,625	39,497	2,364	2,273	22,396	2,414	22,898	7,766	13,977	92,955	187,379	31,780	Nil	319,680	Nil	4,145	41,372	2,411
TOTAL MALAYA	11,625	54,586	20,295	21,105	218,186	17,507	176,834	7,787	13,987	93,062	187,411	48,012	13,936	483,849	186,914	4,145	58,765	21,800

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	11,652	30,123	4,479	3,295	929	50,478
WET RUBBER	2,599	2,604	694	177	1,463	7,537
TOTAL ...	14,251	32,727	5,173	3,472	2,392	58,015

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	31,820	314853
Penang ...	11,925	111236
Port Swettenham.	4,096	53,610
Malacca ...	171	4,150
MALAYA ...	48,012	483849

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	36,027	386694
Straits Settlements		
MALAYA ...	36,027	386694

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.MS., at Singapore on 21st December, 1931.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	88.9	72.0	80.4	95	70	80	74	82.9	83.8	10.89	276.6	2.78	21	19	9	3		144.80	4.83	40
Bukit Jeram, Selangor ...	87.3	72.5	79.9	90	70	80	75	83.6	85.3	11.21	284.7	2.31	18	18		3		179.90	6.00	50
Sitiawan, Perak ...	88.6	72.9	80.7	91	70	82	75	83.8	84.5	11.97	304.1	2.82	21	19	6	2		193.40	6.45	
Kroh, Perak ...	86.0	69.4	77.7	90	66	77	72	80.5	81.6	8.47	213.1	1.16	20	18		1		186.85	6.23	
Temerloh, Pahang ...	85.9	71.9	78.9	91	70	75	74	82.8	85.1	12.49	317.3	1.81	20	16	1	12		143.50	4.78	40
Kuala Lipis, Pahang ...	86.2	71.2	78.7	91	68	74	73	82.6	83.6	9.03	229.4	1.84	17	15	5	12		154.75	5.16	43
Kuala Pahang, Pahang ...	83.6	73.7	78.7	87	72	76	79	81.2	82.9	34.86	855.5	10.16	22	21		1		177.35	5.91	50
Mount Faber, Singapore ...	87.4	73.6	80.5	92	71	81	75	80.2	82.4	10.48	266.2	2.14	18	15	4			148.30	4.94	41
Butterworth, Province Wellesley ...	87.1	73.4	80.3	89	71	81	75	83.7	84.6	6.82	173.2	1.21	16	16				229.20	7.64	
Bukit China, Malacca ...	85.1	73.2	79.1	90	71	80	75	81.4	83.2	8.56	217.4	1.28	20	18	4			174.10	5.80	48
Kluang, Johore ...	87.0	71.6	79.3	91	69	79	73	81.2	82.4	10.73	272.5	2.79	19	16	4	6		138.55	4.62	39
Bukit Lalang, Mersing, Johore	83.7	71.8	77.7	87	69	77	74	80.5	81.1	19.41	493.0	4.82	21	20				152.95	5.10	43
Alor Star, Kedah ...	88.4	72.6	80.5	91	71	83	75	84.5	85.3	9.24	234.7	3.38	15	10		2		214.10	7.14	60
Kota Bahru, Kelantan ...	84.7	72.4	78.5	88	70	78	76	81.9	83.8	29.99	761.7	9.85	17	16	1			201.20	6.71	57
Kuala Trengganu, Trengganu	84.6	72.3	78.5	88	70	79	74	80.3	81.0	30.68	779.3	6.60	17	17		1		179.25	5.97	50
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	70.6	58.4	64.5	75	52	65	60			11.84	300.7	1.83	28	21	2	5		144.75	4.83	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	70.4	57.1	63.7	74	50	66	62	68.8	69.4	11.89	302.0	2.11	27	22	2	7		134.45	4.48	38
Fraser's Hill, Pahang 4268 ft.	70.9	61.5	66.2	77	59	65	63	70.7	71.1	15.22	386.6	3.11	24	23	2	24		113.00	3.77	31

Compiled from Returns supplied by the Meteorological Branch, Malaya.